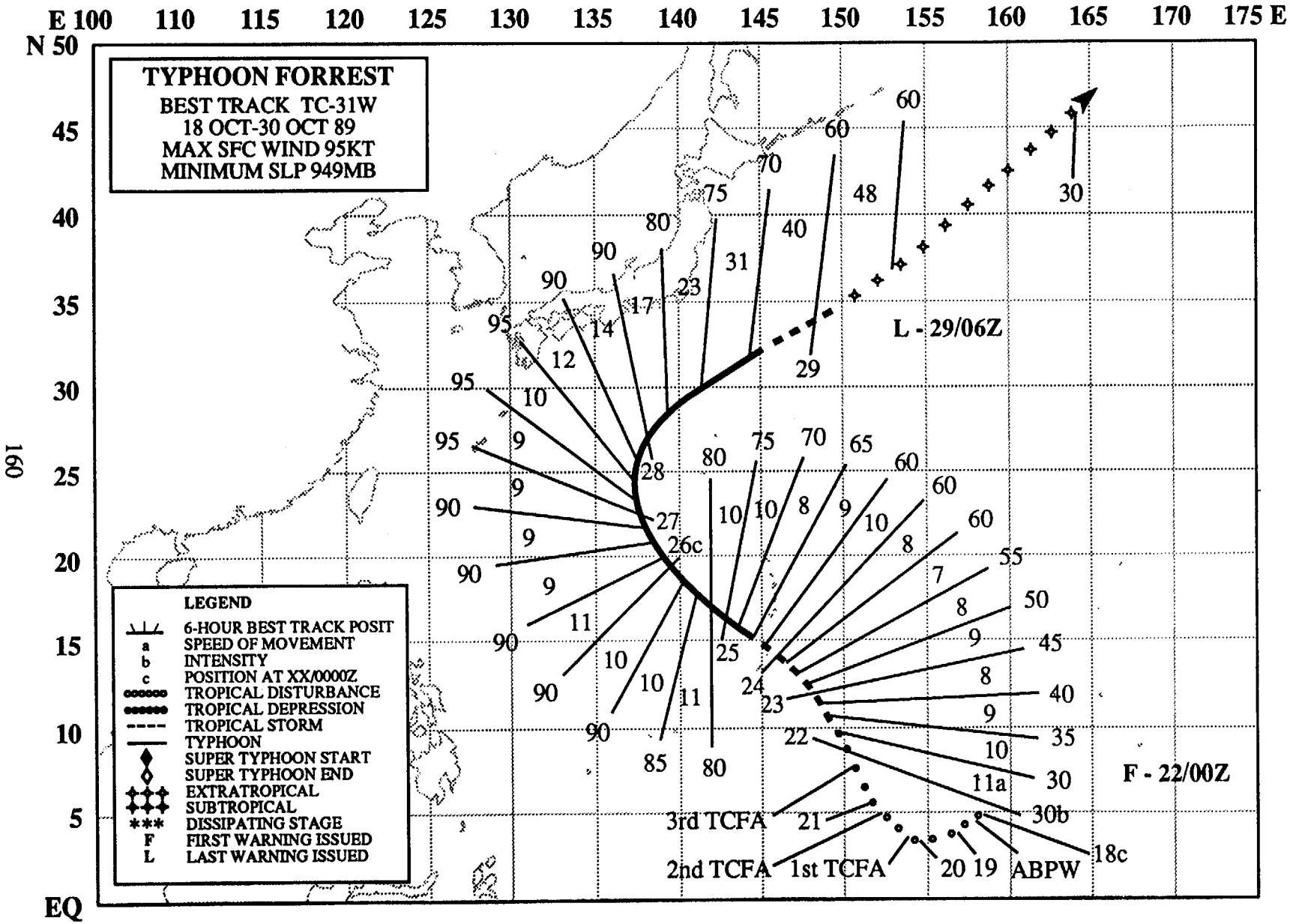

TYPHOON FORREST
BEST TRACK TC-31W
18 OCT-30 OCT 89
MAX SFC WIND 95KT
MINIMUM SLP 949MB
E 100 110 115 120 125 130 135 140 145 150 155 160 165 170 175 E
N 50 45 40 35 30 25 20 15 10 5 EQ
160
LEGEND
6-HOUR BEST TRACK POSIT
a SPEED OF MOVEMENT
b INTENSITY
c POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
*** DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
L - 29/06Z
F - 22/00Z
3rd TCFA
2nd TCFA
1st TCFA
ABPW

TYPHOON FORREST (31W)

The last of six tropical cyclones in October and the 17th typhoon of the year, Forrest was slow and erratic in its development. In fact, JTWC issued and reissued three Tropical Cyclone Formation Alerts before finally disseminating the first warning on Tropical Depression 31W. Throughout its early life, Forrest was a sloppy, broad system with large diurnal variations in its convection. After passing Guam, Forrest finally intensified and ultimately became a 95-kt (49- m/sec) typhoon. Soon thereafter, it recurved and accelerated rapidly to the northeast, becoming one of the year's strongest extra-tropical cyclones in the Pacific. Forrest's track was striking in its similarity to the track of Typhoon Colleen (28W).

As Super Typhoon Elsie (30W) approached the northern Philippines on 17 October, the near-equatorial trough reestablished itself through the Marshall and eastern Caroline Islands and generated a tropical disturbance. JTWC initially discussed the disturbance located about 100 nm (185 km) south of Pohnpei on the Significant Tropical Weather Advisory on 18 October. During the next two days, the disturbance moved toward the west-southwest. Then on the morning of 20 October, it took a turn to the northwest approximately 180 nm (335 km) southeast of Truk. At 200200Z, JTWC issued the first of three Tropical Cyclone Formation Alerts, when the apparent cloud rotation on animated cloud imagery changed from anticyclonic to cyclonic, indicating the development of organized deep convection. From 20 to 22 October, the disturbance (Figure 3-31-1) underwent extremely large diurnal fluctuations in convection creating a broad circulation center and slowing intensification. The disturbance passed about 45 nm (85 km) west of Truk in the evening of 21

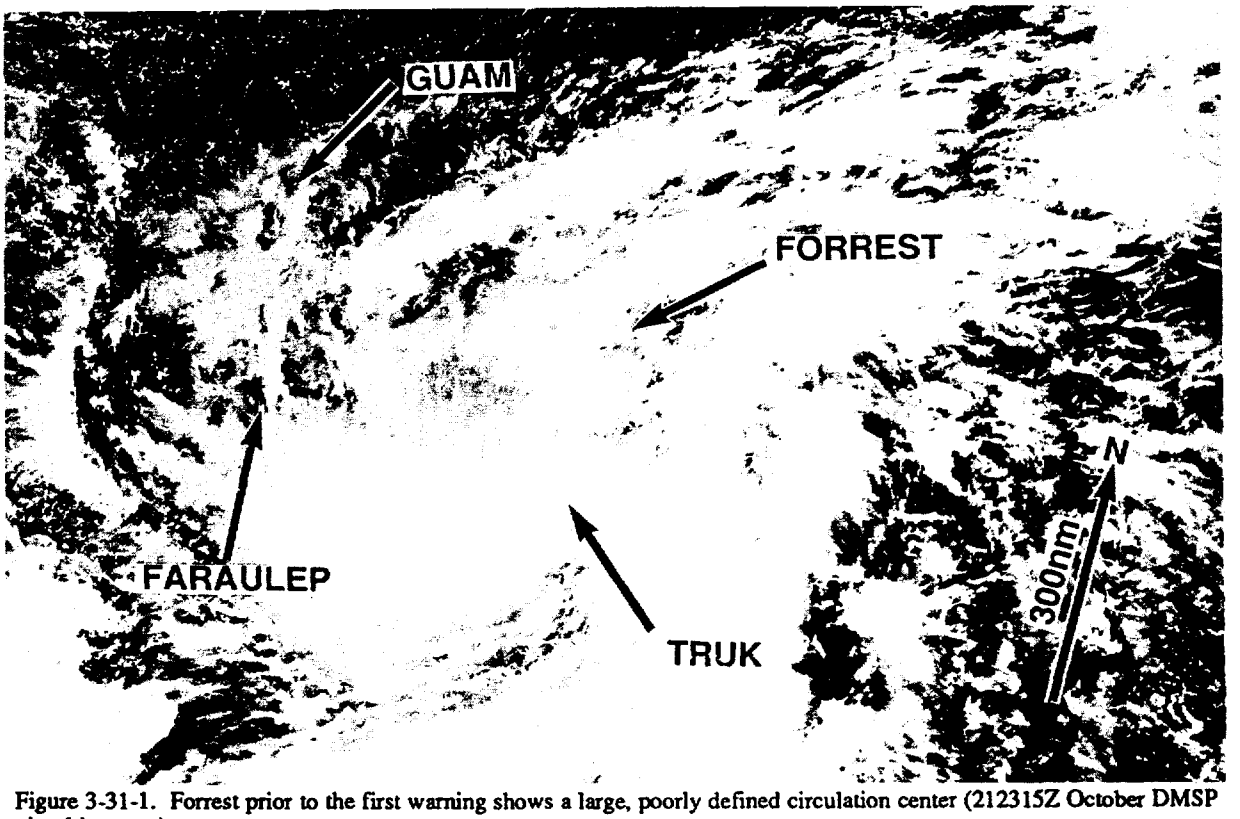


Figure 3-31-1. Forrest prior to the first warning shows a large, poorly defined circulation center (212315Z October DMSP visual imagery).

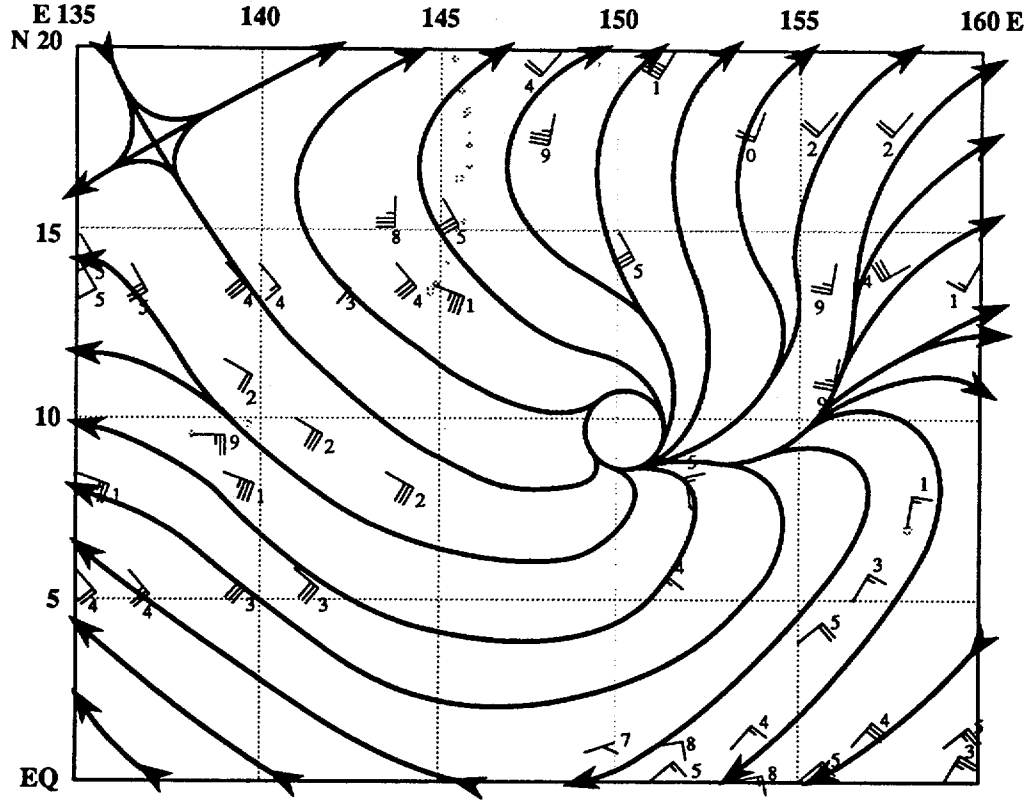
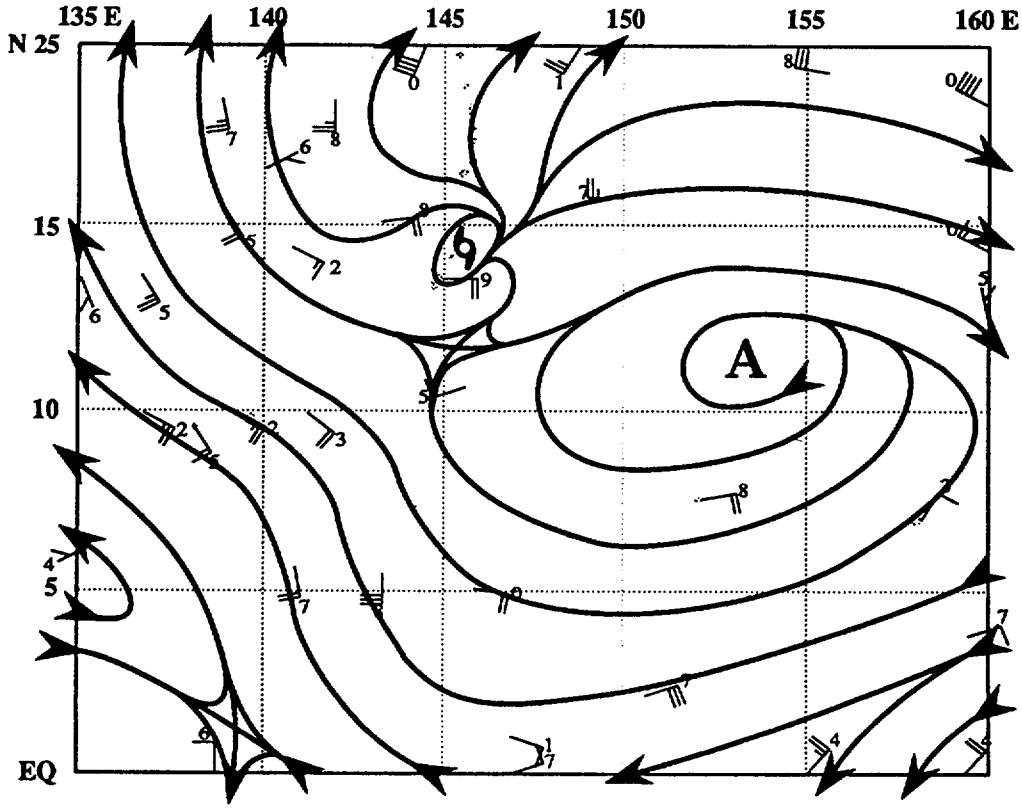


Figure 3-31-2. (a) 230000Z October 200 mb composite streamline analysis showing unrestricted outflow channels to the north and south. (b) 231200Z October 200 mb composite analysis showing the large anticyclone southeast of Forrest's main upper-level circulation center.



October. From 212100Z to 230900Z, Truk experienced sustained 20 to 25 kt (10 to 13 m/sec) surface winds from the monsoon surge associated with the disturbance. At 222000Z, the first warning was issued on Tropical Depression 31W as it reached 30 kt (15 m/sec) and developed efficient outflow channels to the north and south. Twelve hours later, the depression was upgraded to a tropical storm. Forrest moved toward the northwest and intensified at a rate of 5 kt (3 m/sec) every 6 hours. Forecasters at JTWC expected Forrest to reach typhoon intensity as it approached Guam and to rapidly intensify 24 hours later. However, on 23 October the southern outflow channel was completely severed as a large upper-level anticyclone developed to the south of the cyclone (Figure 3-31-2) as a result of the vigorous convection in the rainband to the southeast (Figure 3-31-3). This, coupled with

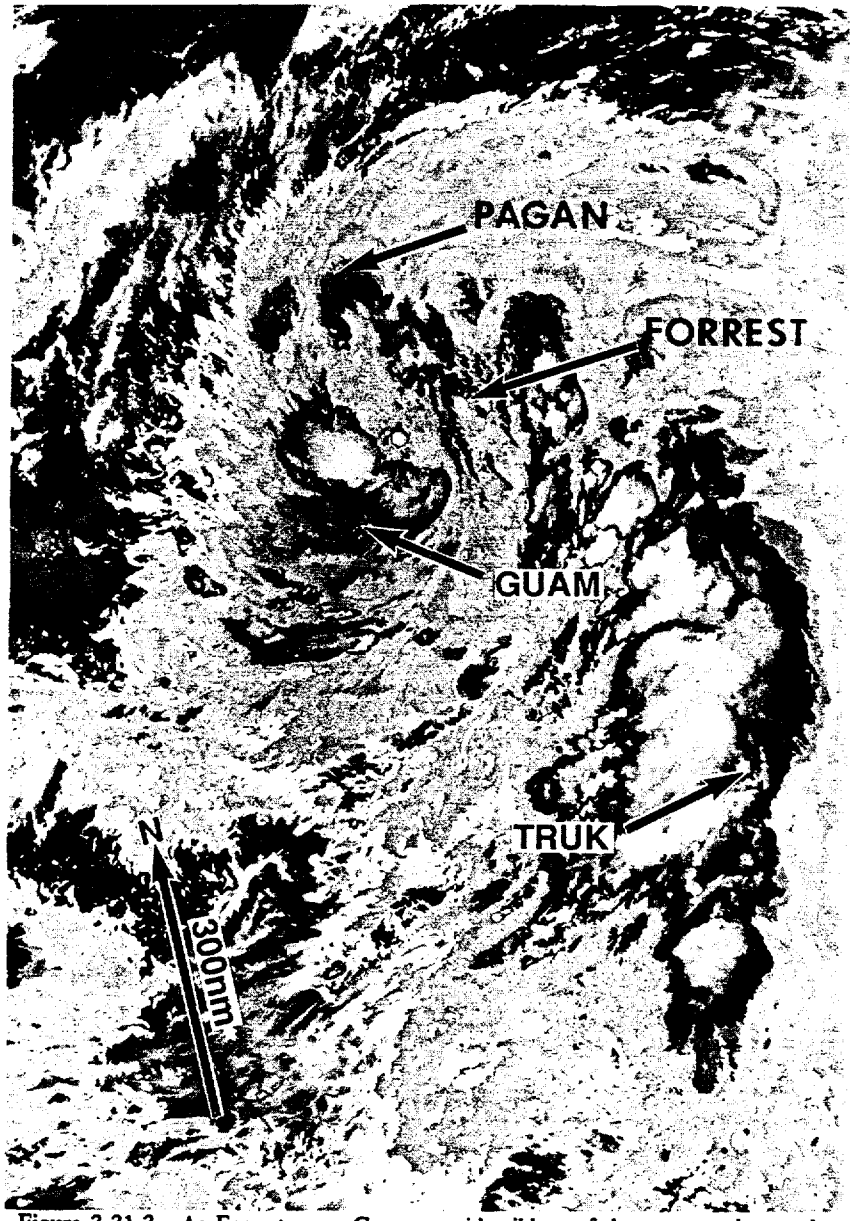


Figure 3-31-3. As Forrest nears Guam, a wide ribbon of deep convection to the southeast of the center contrasts with small area of central convection (232207Z October NOAA visual imagery).

the normal tendency for suppressed daytime convection, resulted in a convectively inactive, broad circulation center. Without the organized convection, winds remained relatively strong aloft, but weak at the surface, especially over land. At 240800Z, Forrest passed within 75 nm (140 km) of the International Airfield on Guam. The weather station (WMO 91212) recorded gusts to 34 kt (18 m/sec) and a minimum sea level pressure of 998 mb. Strong vertical wind shear the following day did ground aircraft on Guam and Saipan. During the day, convection remained disorganized, but about 8 hours after passing Guam, convection rapidly increased and Forrest, which was close to Saipan, intensified and formed a banding type eye. Even though the typhoon was moving away from Saipan, it buffeted the island with moderately strong winds, downing tree limbs and power lines. The airport at Saipan (WMO 91232) recorded a

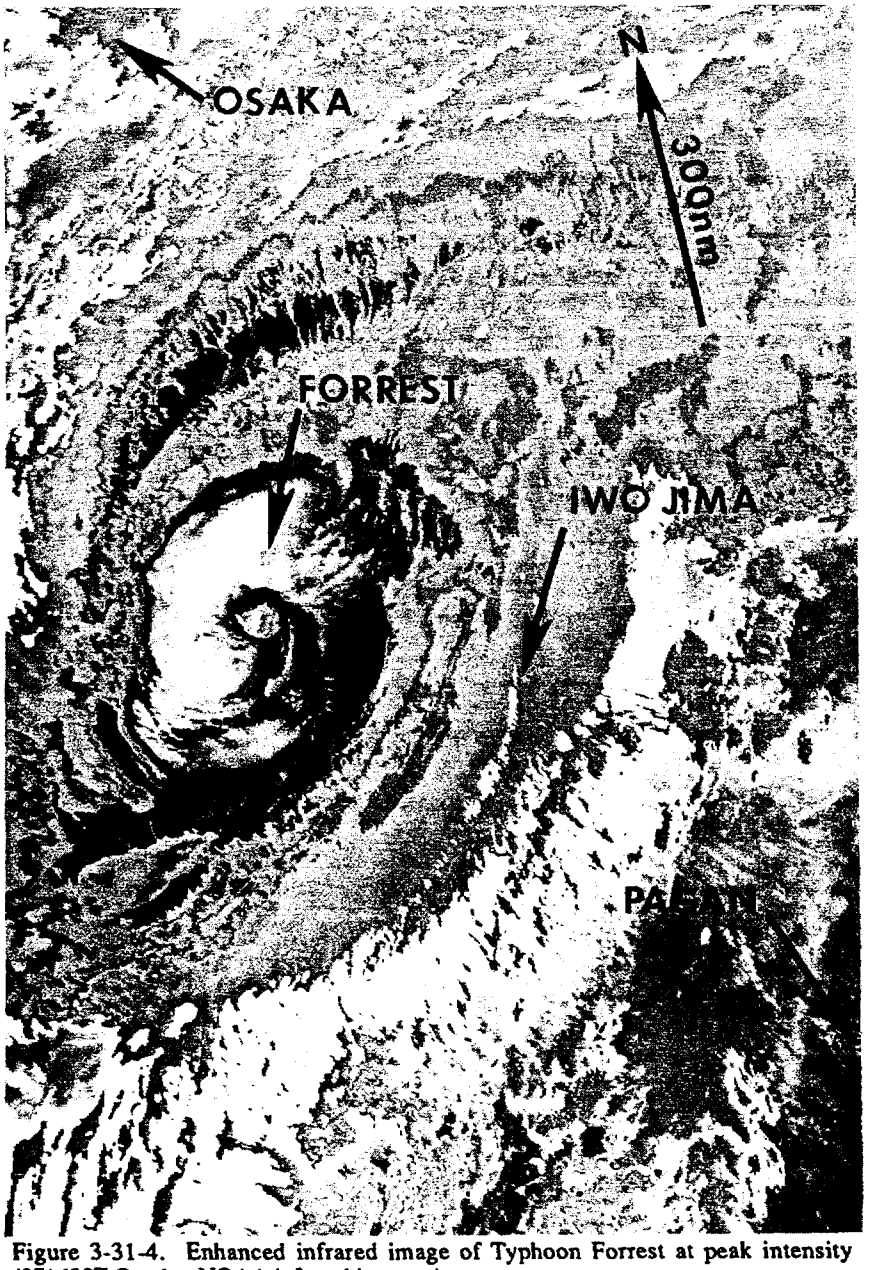


Figure 3-31-4. Enhanced infrared image of Typhoon Forrest at peak intensity (271632Z October NOAA infrared imagery).

minimum pressure of 991 mb at 250400Z, several hours after Forrest had passed. Capitol Hill at an elevation of 1000 ft (305 m) above sea level unofficially recorded wind gusts to 50 kt (26 m/sec). Reports stated that Forrest left most of the island without power, stopped air travel, closed schools, and flooded low-lying areas.

The typhoon continued its northwestward track at an average speed of 10 kt (19 km/hr). Twelve hours prior to recurvature, Forrest attained its peak intensity of 95 kt (49 m/sec) as it crossed the axis of the mid-tropospheric sub-tropical ridge (Figure 3-31-4). Following recurvature at 271200Z, the cyclone began to accelerate to the northeast. On the evening of 26 October, a typhoon acceleration prediction technique (Weir, 1982) used to help determine the timing of recurvature and acceleration indicated that Forrest was about to recurve, and that it would rapidly accelerate. In response, JTWC altered its forecast considerably to reflect the anticipated changes. This caused the **USS Carl Vinson** battle group to alter its course from one passing across the storm's expected track to one that kept it northwest of that track off the coast of Japan. While recurvature and acceleration were delayed 12 to 18 hours making and the speed of JTWC's forecast too fast, the direction forecast was correct. Remaining over relatively warm water and maintaining an efficient outflow channel into the mid- latitude westerlies, Forrest did not rapidly weaken. At 281200Z, the typhoon had accelerated to nearly 30 kt (56 km/hr), and still packed 75-kt (39-m/sec) winds, partly as a result of its rapid motion along track. At this time, Forrest passed within 175 nm (325 km) to the northwest of Chichijima (WMO 47971) where 850 mb winds were recorded at 230 degrees at 65 kt (33 m/sec). Interacting with the mid-latitude westerlies, Forrest's convective heat engine finally gave way to baroclinic energy-producing processes and the storm became extratropical while moving northeastward at nearly 50 kt (93 km/hr). The final warning on Typhoon Forrest was issued at 290600Z. Like Colleen, the resulting extratropical system became one of the strongest winter storms in the Pacific during 1989, packing storm force winds in excess of 60 kt (31 m/sec).